APPENDIX F

ADM VERIFICATION WELL #1

MECHANICAL INTEGRITY LOG AND TESTING DESCRIPTIVE REPORT

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Mechanical Integrity Log and Testing Descriptive Report

Bob Butsch – Schlumberger Carbon Services

Jim Kirksey – Schlumberger Carbon Services

This document will describe the logging and testing programs related to the mechanical integrity of this well. It will also contain the analysis of the data collected, with the goal of demonstrating that the well is mechanically sound, and that no fluids will flow into the USDW at this site.

The Casing and Logging Program

Three casing strings were run in the ADM Verification Well #1 well. Logging runs investigating and verifying the baseline mechanical integrity of each casing string were made, and will be discussed in this document. Many other types of logs were run during installation of the borehole for the purpose of characterizing site geologic conditions. A discussion of those logs is available in the well completions report.

The surface casing string was run from surface to 367 ft and consisted of 13 3/8 inch, 54.5 lb/ft casing. The intermediate casing string was run from surface to 5305 ft and consisted of 9 5/8 inch, 40.0 lb/ft casing. The production casing string was run from surface to 7260 ft and consisted of 5 1/2 inch 17.0 lb/ft casing. The lower 2163 ft was CR-13 chrome and from 5047 back to surface was N-80. All three casing strings were cemented to surface. Figure 1 is a wellbore diagram showing the casing configuration.

A Cement Bond Log (CBL) was run in each of the casing strings to help evaluate the cement of each casing string. The CBL transmits a sonic signal from a transmitter, and then measures the amplitude of that sonic signal after traveling through a section of the casing. If there is cement in the casing annulus the amplitude of the sonic signal will be attenuated and the amplitude of the sonic signal measured will be small. How small the amplitude actually becomes is dependent on many factors, including the percent of the casing bonded, the type of cement, and many of the casing properties to name a few.

To evaluate the casing and cement of the intermediate casing string an Ultrasonic Imager Tool (USIT) was used in combination with a CBL. The USIT uses a single transducer mounted on an ultrasonic rotating sub on the bottom of the tool. The transmitter emits ultrasonic pulses between 200 and 700 kHz and measures the received ultrasonic waveforms reflected from the internal and external casing interfaces. The rate of decay of the waveforms received indicates the quality of the cement bond at the cement/casing interface, by computing an acoustic impedance of the material outside the casing. The time for the signal to be transmitted and reflected back to the transducer is used to measure the internal radius, and the resonant frequency of the casing provides the casing wall thickness required for pipe inspection. Because the transducer is mounted on the rotated sub, the entire circumference of the casing is scanned. This 360º data coverage enables the evaluation of the quality of the cement bond as well as the determination of the internal and external casing condition.

To evaluate the mechanical integrity of the production string of casing the Isolation Scanner tool was used in combination with the CBL and a Multi-finger Caliper Log (PMIT). The Isolation Scanner combines the same ultrasonic measurement as the USIT with a measurement of Flexural Wave Attenuation. The Flexural Attenuation measurement incorporates one ultrasonic transducer acting as the transmitter and two ultrasonic transducers acting as receivers to determine how much a flexural wave is attenuated after traveling through the casing. This measurement is more sensitive to cements that have low acoustic impedances than the USIT and can help identify when these cements are present. The measurements of acoustic impedance and flexural wave attenuation are combined into an interpretation breaking down the interpretation into solid (cement), liquid (water, mud, oil), and gas to make the visualization of the interpretation easy. The Multi-finger Caliper provides a baseline measurement of the internal radius as well as providing another measurement of the internal radius that can be compared to the measurement coming from the USIT.

Another log run that will be used to monitor changes in the mechanical integrity of the well is the Reservoir Saturation Tool (RST). This tool will primarily be used to monitor the CO_2 in the reservoir but also has several measurements that can be used to identify CO_2 that might be migrating up in any of the casing annuli. As expected, the base pass of the RST showed no indications of CO_2 present in any of the annuli. The portion of the log data that was related to the reservoir was consistent with the petrophysical analysis of the reservoir as described in the Geophysical Log Descriptive Report. The RST is most effective when used as a monitor log with subsequent monitoring passes. This is the base pass of the RST and these measurements will be compared to the same measurements on subsequent runs of the tool.

Analysis of the Well Integrity Logs

The CBL on the surface string of casing shows that from 253 to 262 ft. and at 189 ft. the amplitude measures just under 2 mv. This translates into an attenuation of 9.2 dB/ft. Using this value to compute the compressive strength of the cement at this interval, a value of approximately 2000 psi is obtained and the interval is believed to be a 100% bonded interval. To demonstrate zone isolation it is desirable to have a continuous interval with the attenuation greater than 6 dB/ft. The attenuation is greater than 6 dB/ft from 253 to 262 ft., from 232 to 226 ft., and a total of 15 ft. between 212 ft. and 184 ft. Ideally it would be preferred that the cement were more continuous. However, there are several additional considerations. There are also several other intervals in the well have attenuations in the 4 to 6 dB/ft range where cement is certainly present. Also, it is known that cement was circulated to surface and that the cementing job was executed according to plan with no observed fallback even though the CBL does not indicate the presence of cement above 148 ft. Given this information it is believed that the CBL is showing good hydraulic isolation in the zones mentioned and a sufficient amount of cement behind the casing up to 148 ft. This volume is sufficient to prevent any fluids from flowing from below in to any USDW behind the casing in this interval as is the objective of this casing string.

Figure 2 shows the results of the USIT and a brief description of the log is as follows:

Track1 – Gamma Ray and other QC type data.

Track 2 - Amplitude of the received ultrasonic signal (light colors are high amplitude)

Track 3 and 4 – Casing cross section showing minimum, maximum and average internal radius and average external radius.

Track 5 – Internal radius image

Track 6 – Minimum, maximum and average casing thickness.

Track 7 – Casing thickness image

Track 8 – Acoustic impedance image

Track 9 – Bond index presentation (yellow = cement, blue = liquid, red = gas, green = solid)

Track 10 – Interpreted acoustic impedance image (any shade of brown = cement, blue = liquid, red = gas, green = solid)

The USIT log also shows that the casing has no internal or external defects at this time based on the internal radius and thickness measurements.

The production string of casing was also determined to have good hydraulic isolation over most of the length of the casing, with only short intervals where there are isolated pockets of fluid and not cement behind the casing. The top of the injection zone is 5520 ft. and the first of these intervals below this point that has any potential to flow fluids is a very short interval from 5564 to 5570 ft. It is actually more likely that this zone has a thin cement sheath rather than a channel. The casing below this point is all considered to be 100% bonded with good hydraulic isolation. Above the base of the confining layer the first potential channel would be from 4314 to 4306 ft. Therefore, there is no potential for any fluids to migrate from the injection zone to zones above the confining layer by way of the casing-formation annulus. The acoustic impedance image of the USIT clearly shows the change in acoustic impedance for the two different cement types used while cementing this string of casing. This change occurs at about 4900 ft, indicating that the CO_2 resistant cement was brought up into the annulus of the long string and the intermediate string of casing. Figure 3 shows the Isolation Scanner log on this casing string and a brief description is as follows:

Track1 – Gamma Ray and other QC type data.

Track 2 – Diagnostic track – the processing of the tool is model based and this track indicates any deviations of the model.

Track 3 - Amplitude of the received ultrasonic signal (light colors are high amplitude)

Track 4 and 5 – Casing cross section showing minimum, maximum and average internal radius and average external radius.

Track 6 – Internal radius image

Track 7 – Minimum, maximum and average casing thickness.

Track 8 – Casing thickness image

Track 9 – Acoustic impedance image

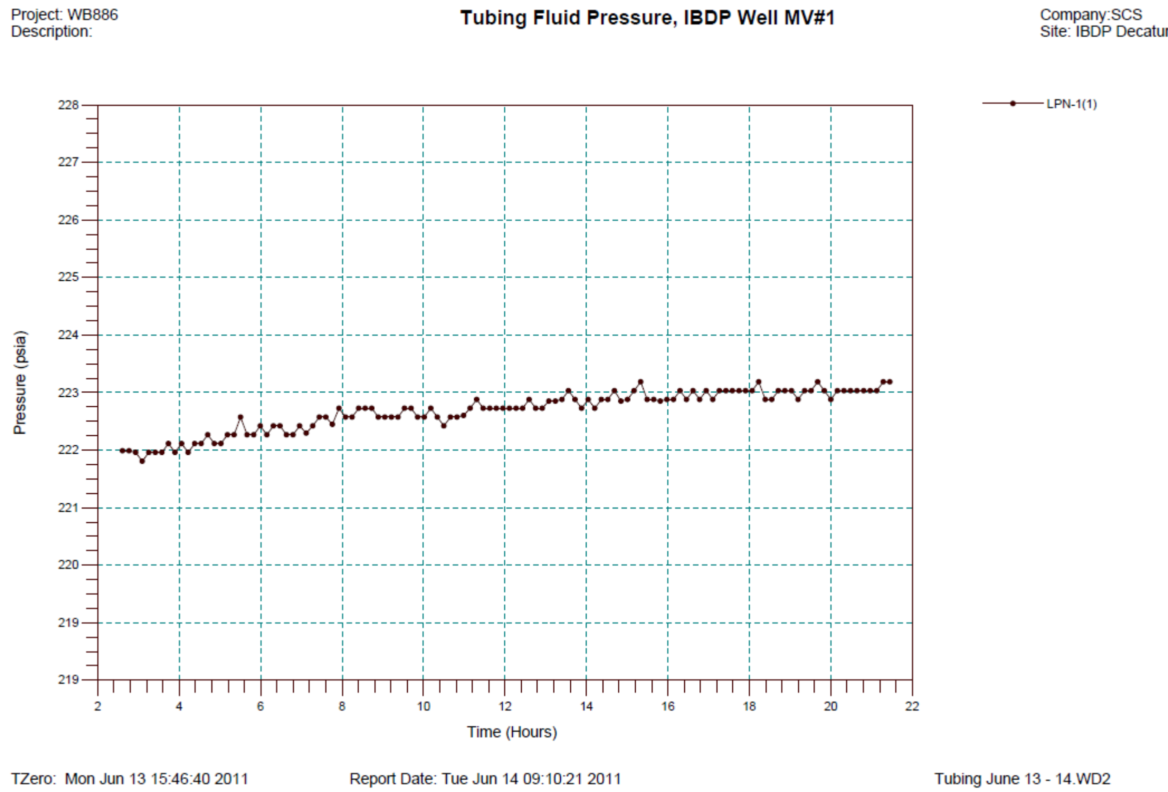
Track 10 – Bond Flexural Wave Attenuation image

Track 11 – Interpreted Solid/Liquid/Gas image (brown = cement, blue = liquid, red = gas)

The USIT part of the Isolation Scanner and the PMIT also show that the casing has no internal or external defects at this time based on the internal radius and thickness measurements. The PMIT was run after the casing was perforated in the zones to be monitored by the Westbay system, and these perforations can be seen on the log. The perforations were not considered as defects as the holes were intentional and part of the completion.

Mechanical Integrity Tests

During installation the Westbay tubing was tested using negative differential tests which monitored the fluid level inside the tubing daily while running the system into the well. The Westbay system is a sealed tube so fluid was added to the tubing string while running in to keep the fluid level approximately 250 feet lower than the fluid level in the annulus which had been established to stand at approximately 250 feet below surface with a 9.2 ppg completion fluid in the well. The maximum differential was reached on May 25 when the fluid level inside the tubing was at 1965 feet and the annulus at 250 feet below surface with no change in fluid level. After packer inflation the gas lift valve was used to lower the fluid level in the well to approximately 1122 feet below surface. The pressure probe was at a counter depth of 1530 feet. The well was data logged overnight June 13-14 with less than 1 psia change in pressure and was absolutely stable for the last six hours of the test. This chart is included below. This established the integrity of the Westbay tubing with a negative differential much greater than 100 psig. Additionally, each joint of the Westbay tubing and each component connection was hydro- tested to 150 psia while running in the hole.



On June 7, 2011 after inflating Packer 27 the pumping port between packers 27 and 28 located at 4785 was opened and the well was circulated down through the tubing and out the annulus. First 20 bbls of 9.2 ppg NaCL brine completion fluid was pumped to clean the hole ahead of final completion brine. Then 78 bbls of 9.4 bbl NaCl with Nalco ASP 539D corrosion inhibitor was pumped. The treated fluid was then followed by a tubing volume (27.8 bbls) of 9.4 NaCl brine with no corrosion inhibitor to displace the tubing. Treated brine was returned to surface. The pumping port was closed and the annulus was tested to 200 psi with no increase in tubing pressure as measured by a Westbay gauge inside tubing. The uppermost packer number 28 at approximately 4826 was inflated. After recovering the packer inflation tools the annulus was tested using the Westbay inflation pump to 300 psi on June 9, 2011. The tubing was full and no fluid movement was noted during the test. On June 10, 2011 the annulus was re-pressured to 317 psia with Jeff Turner of the IEPA on site to witness the test. Again the tubing was full of fluid and no fluid movement was seen from the tubing. The pressure held for one hour with no leak off. Jeff Turner was provided with a chart and the data from test. This test established the mechanical integrity of the uppermost Westbay packer and the tubing above it to surface. Previous to this annular test the casing had been successfully tested on three other occasions during the completion of the well.

After packer inflation the QA/QC zone was monitored and continuously logged from July 17 to the beginning of the second round of fluid testing on September 8, 2011. The QA/QC zone behaved as expected with such a small volume of fluid between the QA/QC straddle packers. When the well warms up, as happens when flowing warmer fluids from the bottom zones, the pressure increases and likewise decreases when the well cools off. The QA/QC zone can also experience pressure changes as a result of the mechanical process of engaging and dis-engaging the pressure transducer probe at the measurement port. The adjacent zones showed a normal buildup after purging while the QA/QC zone responded to temperature. An example of the data is as follows from the post purging pressure profile run on July 8, 2011:

Zone 9	5653.8 ft KB	pressure 2533.6 psia, gradient = .4481 psi/ft
QA/QC Zone	5482 ft KB	pressure 2243.1 psia, gradient = .4091 psi/ft
Zone 10	5000.6 ft KB	pressure 2111.1 psia, gradient = .422 psi/ftd the QA/QC zone

This establishes the mechanical integrity of the QA/QC zone.

Conclusion

Based on the analysis of the log data and well test information, this well meets the requirements for mechanical integrity and is protective of groundwater.

Robert J. Butsch

Bob Butsch
Petrophysical Advisor
Schlumberger Carbon Services
14090 SW Freeway, Suite 240
Houston, TX 77478
+1 (281) 285-3485 Work
bbutsch@slb.com
Member – Society of Petrophysicist and Well Log Analysts, Society of Petroleum Engineers

Jim Kirksey
Project Manager / Completion Engineering Mgr.
Schlumberger Carbon Services
C/O Illinois State Geological Survey
University of Illinois Champaign-Urbana
615 E. Peabody Drive
Champaign, IL 61820
+1 (217) 333-6236
Member – Society of Petroleum Engineers

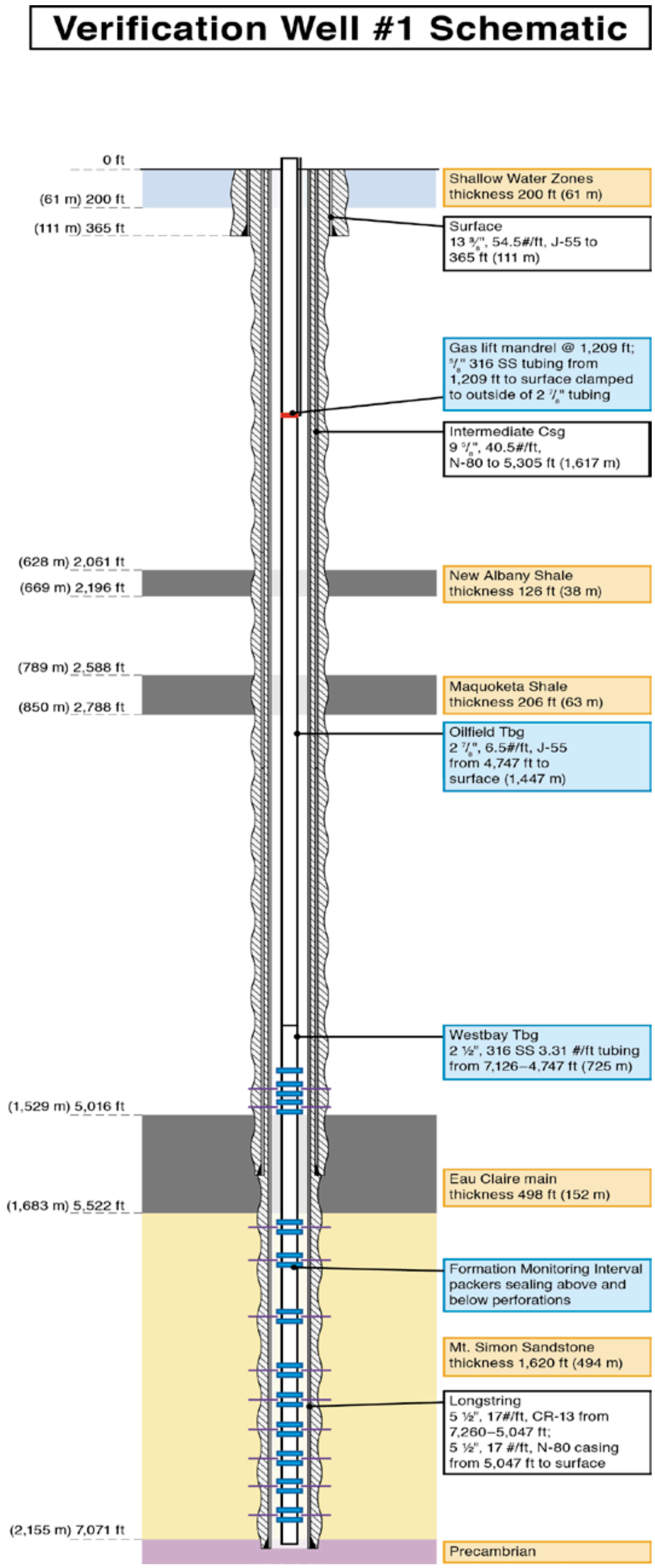


Figure 1 – Wellbore Diagram

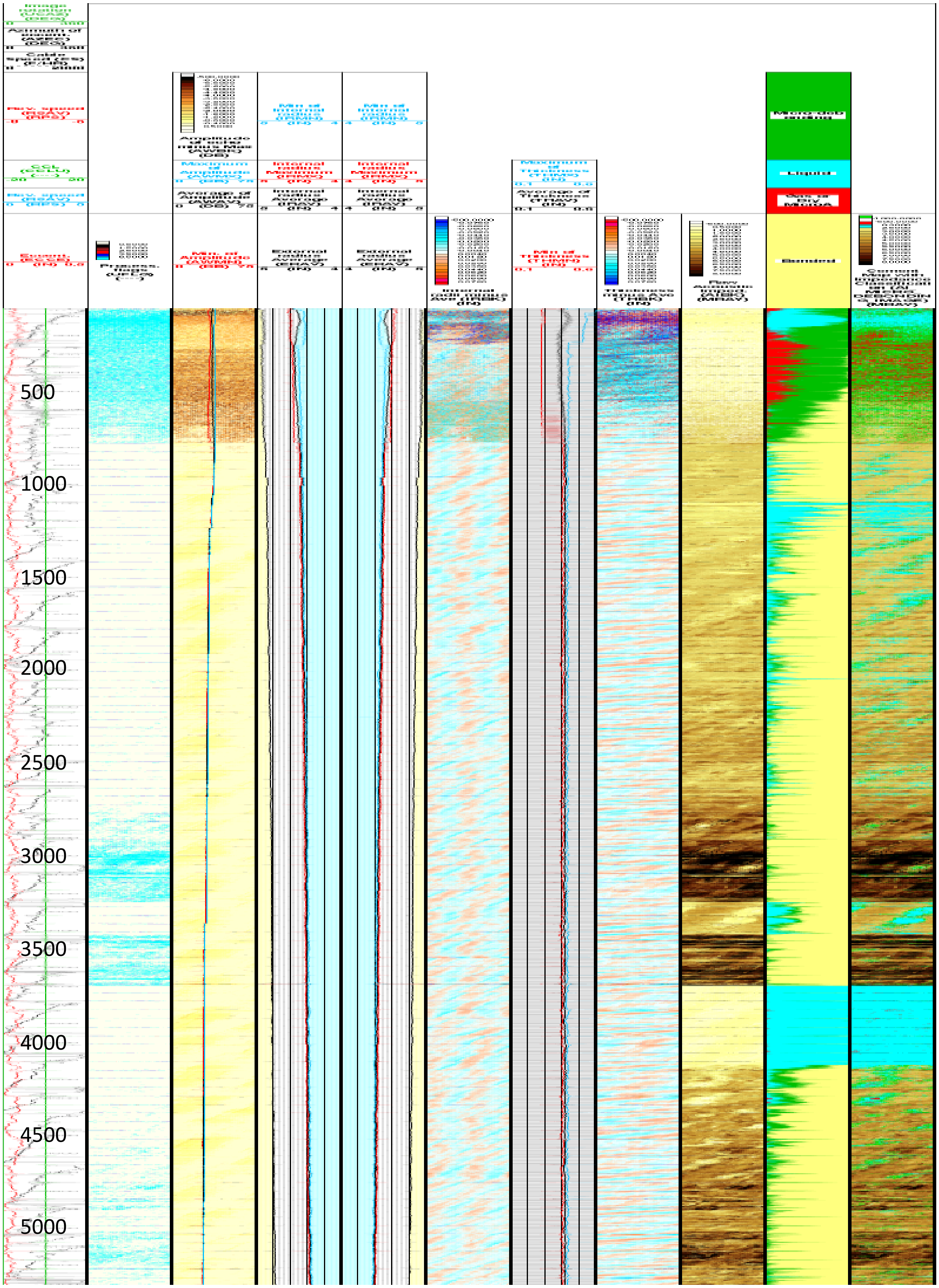


Figure 2 – USIT Intermediate Casing String

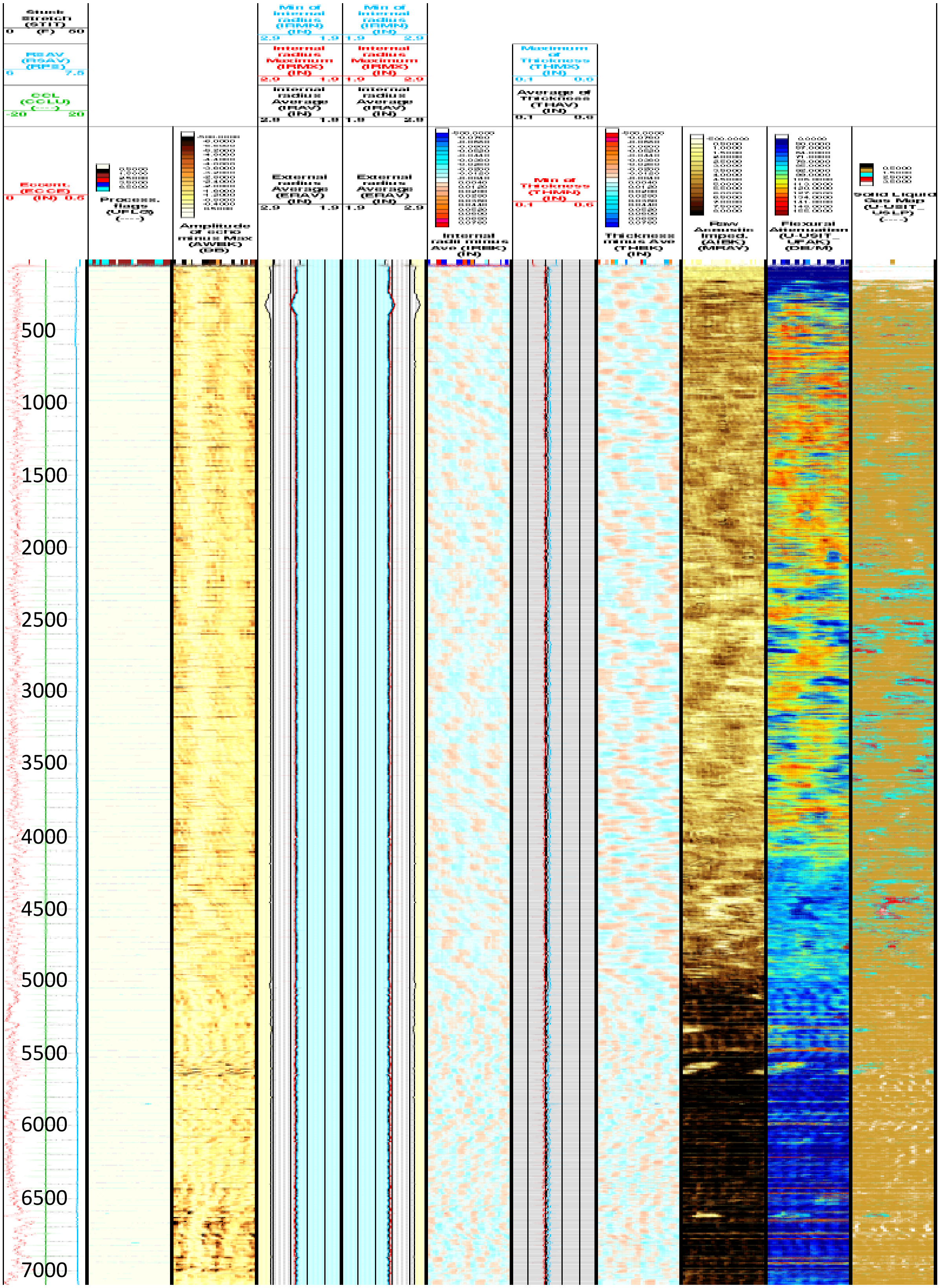


Figure 3 – Isolation Scanner Production Casing String